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Mollusc community of a *Posidonia oceanica* (L.) Delile bed: annual variability

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KEY WORDS: *Mollusc, Posidonia oceanica*, Mediterranean, *Bittium latreillii.*

ABSTRACT: The annual variation of a Mollusc community from a *Posidonia oceanica* bed was studied using the air-pump method. The annual qualitative, quantitative and structural analysis of the mollusc community is reported together with the annual trend of the dominant species, *Bittium latreillii.* The community dynamic seems to be affected mainly by the annual variation of Bittium latreillii and its life cycle may be considered a very important factor in structuring the mollusc community

RIASSUNTO: E' stata studiata la variazione annuale della comunità a molluschi di una prateria di *Posidonia oceanica* con il metodo dell'aspiratore idraulico (sorbona). E' stata condotta un'analisi qualitativa, quantitativa e strutturale della comunità, ed è stato analizzato l'andamento annuale della specie dominante, *Bittium latreillii.*
Sono stati raccolti complessivamente 2028 individui: 1961 Gasteropodi (96,7%), 67 Bivalvi (3,30%). Gli individui campionati sono risultati appartenenti a 57 specie, delle quali 49 di Gasteropodi, 8 di Bivalvi. E' stato analizzato l'andamento annuale della malacofauna campionata. La media dei valori del numero di specie mostra i valori più elevati nel mese di Gennaio ed in Marzo, mentre il minimo si ha in Settembre. L'andamento annuale della media dei valori dell'abbondanza mostra un picco in Novembre, mentre il valore minimo si registra in Gennaio.
Inoltre é stato analizzato l'andamento annuale delle quattro specie numericamente più importanti, tra le quali *Bittium latreillii* è la specie dominante. I valori di massima e minima abbondanza di questa specie coincidono con i valori di massima e minima abbondanza del popolamento a molluschi campionato. L'andamento annuale della comunità sembra, quindi, essere condizionato principalmente dall'andamento annuale di *Bittium latreillii* ed il suo ciclo vitale può essere considerato un fattore importante nella strutturazione della comunità.

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INTRODUCTION

Posidonia oceanica (L) Delile beds are structurally and ecologically complex environments and are considered to consist of different elements: the foliar stratum, the rhizome stratum and the "mattes". Different biocoenoses appear to be associated with the different biotopes along this vertical axis (BIANCHI et al., 1989).

The annual and seasonal trend of mollusc syntaxon has been studied using the hand-towed net method in other *Posidonia oceanica* seagrasses (RUSSO et al., 1984, 1985, 1991), but this method seems to affect mainly the foliar stratum fauna (TERLIZZI & RUSSO, 1996; RUSSO & TERLIZZI, 1997). The same study on the mollusc fauna made using the air-pump method gives very similar results but a different type of selectivity on the malacological community is evident (TERLIZZI & RUSSO, 1996; RUSSO & TERLIZZI, 1997). In nature, marine communities are conditioned and determined by ecological factors divided into two categories: biotic and abiotic factors (PÉRÈS & PICARD, 1964)

This study aims at analysing the malacological taxocoene for the *Posidonia* seagrass of Campese and its annual variability. For this study the air-pump method was used since it provided more complete information on the overall species composition inhabiting a particular *Posidonia* bed (TERLIZZI & RUSSO, 1996; RUSSO & TERLIZZI, 1997).

MATERIAL AND METHODS

Samples were collected at Campese (the island of Giglio, Grosseto, Italy) (Fig.1) every two months between September 1996 and July 1997. The species-samples matrix is showed in Tab.2.

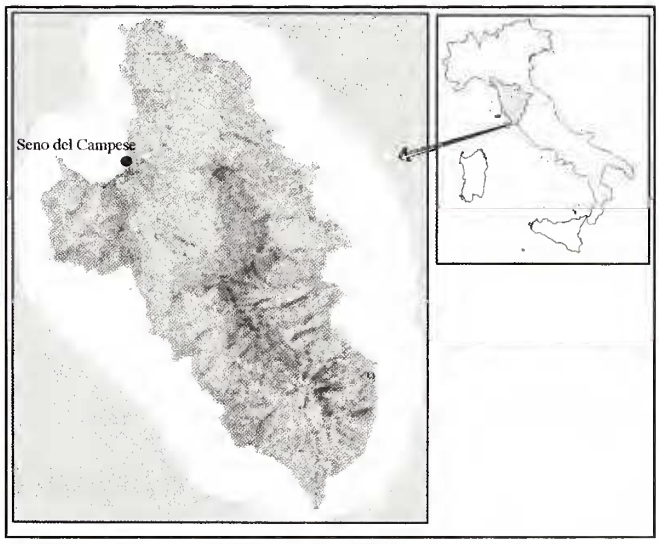

Fig. 1. The Island of Giglio with the sampling site.

Three replicates were made. Sampling stations were placed at depths of 8-9-10 metres. A direct sampling technique, the air-pump method, was used (CORSELLI et al., 1980; DE METRIO et al., 1978; DE METRIO et al., 1980). Every sampling session involved three replicates, 1 m2 each, sampled using a PVC air-pump with a 7 cm-diameter opening and using a nylon sampling bag with a 400m-mesh.

An annual quali-quantitive analysis has been performed. The number of species (S) and the number of individuals (N) have been

considered for each sample and the mean value (standard deviation; standard error) of the three samples for each sampling session has been calculated.

Structural analysis was performed using the index of Shannon's species Diversity (H'), Evenness (J) (PIELOU, 1966) and index of Redundancy (R). Shannon's index (H') measures the level of occurrence of the individuals among the species; Evenness (J) measures the uniformity in distribution of the individuals among the species; the Redundancy index (R) measures the degree of distancing of the community from the H'max, it may be calculated with the following formula (PATTEN, 1962). Formulas of diversity, evenness and redundancy indices investigated in this study are:1)

$$H = S_{i=1}^{n} \frac{n_i}{N} \ln \frac{n_i}{N} = S_{i=1}^{n} P_i \ln P$$

S=Σ

ni=number of individuals of the ith species

N=total number of individuals

Pi=frequency .of the ith species

2) Evenness (J)

J= H'/H max

H'=Shannon index value

Hmax= maximum value of Shannon index

3) R=Hmax-H'/Hmax-Hmin.

The samplings were taken within a very narrow batimetric band characterised by homogenous edaphic factors (8-10m).

RESULTS

The sampling yielded 2028 individuals: 1961 Gastropods (96,7%) and 67 Bivalves (3,30%), belonging to 57 species, 49 Gastropod and 8 Bivalve species.

The annual variation of the mean value of the number of species and individuals has been analysed using the mean value and standard deviation and error of the replicates for each sampling session (Fig.2; Fig.3). The annual trend in number of species shows the highest value in January, March and July (mean value: 16). The highest value for number of specimens was recorded in November (mean value: 163), while the minimum was recorded in January (mean value: 90) (Fig.2;Fig.3). The annual trends of the most important species have also been analysed: *Bittium latreillii* (PAYRAUDEAU, 1826) (64%), *Alvania lineata* RISSO, 1826 (7%), *Tricolia pullus* (LINNÉ, 1758) (7%) and *Bittium jadertinum* (BRUSINA, 1865) (3%) (Fig.4). *Bittium latreillii* is the dominant species and its highest abundance was recorded in November (mean value: 116), the minimum in January (mean value: 47) (Fig.5). *Alvania lineata, Tricolia pullus* and *Bittium jadertinum* were particularly abundant in November, January and March (Fig.4).

Annual trends of H' and J over the cycle of a year are represented in Fig.6; Fig.7 and Tab.1. The mollusc community shows the highest structural level in January (H': 2.7), while the lowest value was recorded in September (H': 1.5). The R trend is specular to the other two indices.

DISCUSSION AND CONCLUSION

The highest mean values of the number of individuals, both for *B. latreilli* and mollusc fauna, are recorded in autumn (November). For a seagrass malacological community the highest abundance value has already been recorded in autumn in a seasonal study by TERLIZZI & RUSSO, (1996).

The maximum abundance in autumn, besides depending on

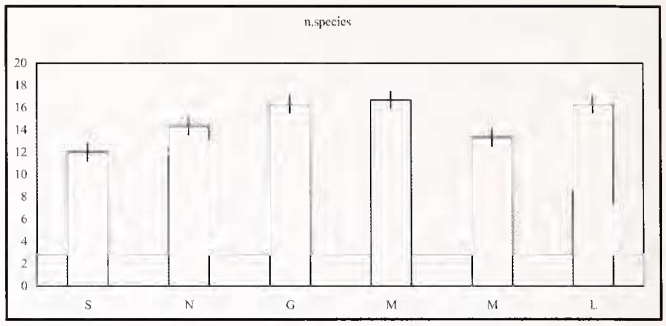

Fig. 2. Number of species of the fauna for each month. "The columns represent the mean value the three replicates, the bars standard error."

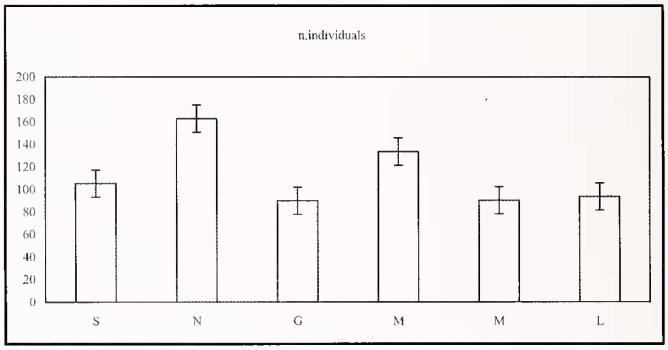

Fig. 3. Number of individuals of the fauna for each month. "The columns represent the mean value the three replicates, the bars standard error."

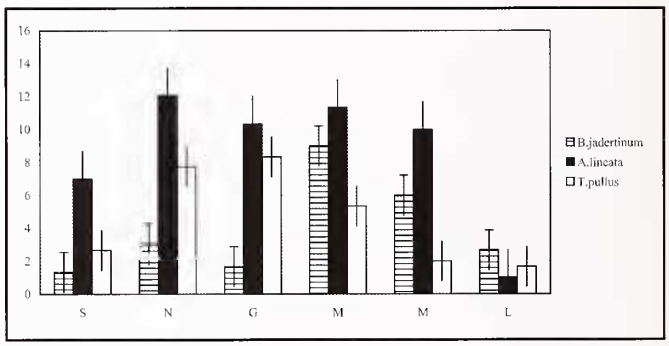

Fig. 4. Number of individuals of the fauna for each month for most abundant species. "The columns represent the mean value the three replicates, the bars standard error."

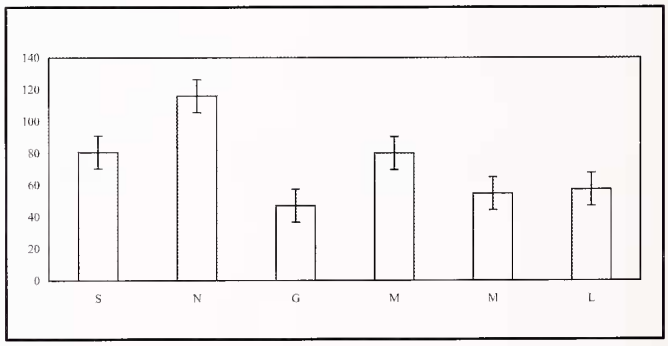

Fig. 5. Number of individuals of B. *latreillii* for each month. "The columns represent the mean value the three replicates, the bars standard error."

	S	S	N	N	J	J	M	M	M	M	J	J
indices	Mean	D.V.	Mean	D.V.	Mean	D.V.	Mean	D.V.	Mean	D.V.	Mean	D.V.
H'	1.49	0.33	2.01	0.54	2.56	0.17	2.38	0.29	2.17	0.20	2.37	0.18
R	0.76	0.11	0.61	0.09	0.56	0.05	0.57	0.04	0.59	0.04	0.61	0.04
J	0.42	0.09	0.52	0.14	0.64	0.01	0.59	0.06	0.59	0.08	0.59	0.03

Table 1. Mean values and standard deviation of H'; J; R.

species/samples	S1	S2	S3	N1	N2	N3	G1	G2	G3	M1	M2	M3	M1	M2	M3	L1	L2	L3
"Smaragdia viridis (Linné,1758)"				3			3					4					4	0
"Emarginula pustula Thiele in Kuester, 1913"																		1
"Clanculus jussieui (Payraudeau,1826)"										2		1						
"Calliostoma laugieri (Payraudeau,1826)"	1												1					
"Gibbula umbilicaris (Linné,1758)"						1							4					1
"Jujubinus exasperatus (Pennant, 1777)"				1	4	1	1		1	6	1	1	5	3	2	1	1	1
"Jujubinus striatus (Linné,1758)"	1	4	1	5	3	1		1		1	2	1	1	2		2	1	4
"Tricolia speciosa (Von Muehlfeldt, 1824)"	2		1	3	5	5		5	1		2	2				1		4
"Tricolia pullus pullus (Linné,1758)"	5	2	1	5	7	11	4	14	7	5	8	3	2	2	2	3	2	
"Cerithium rupestre Risso, 1826"						1												
"Cerithium vulgatum Bruguière, 1792"										1			1					
"Bittium latreilli (Payraudeau,1826)"	65	87	90	42	79	227	33	61	47	136	60	44	74	65	25	48	59	65
"Bittium jadertinum (Brusina, 1865)"	2	0	2	2	3	4	1	3	1	19	6	2	10	6	2	4	2	2
"Rissoa auriscalpium (Linné,1758)"	3	1		3	2	1	2	2		7	2	5	2		2	8	3	10
"Rissoa decorata Philippi,1846"	1																	
"Rissoa guerinii Récluz, 1843"															1			
"Rissoa ventricosa Desmarest,1814"												1						
"Alvania cimex (Linné,1758)"	3	1	1			7			1		1			1		2	2	3
"Alvania discors (Allan, 1818)"								2	2									
"Alvania geryonia (Nardo, 1847)"								1										
"Alvania lineata Risso,1826"	13	6	2	2	6	28	7	20	4	28	6		24	6			3	
"Alvania tessellata Weinkauff, 1868"						1												
"Alvania semistriata (Montagu, 1808)"								1		1								
"Pusillina philippi (Aradas & Maggiore, 1844)"								5	2	4		3	1		3	3	1	1
"Pusillina parva (Da Costa, 1778)"								2										1
Pusillina radiata																	1	
"Payraudeautia intrusata (Philippi,1836)"																1		
"Cheirodonta pallescens (Jeffreys, 1867)"													1			1		2
"Marshallora adversa (Montagu, 1803)"	1	1	2	2	3	5			1			2	1	2	3	2	4	4
"Cerithiopsis minima (Brusina, 1865)"			1						4			2				1		2
"Cerithiopsis tubercularis (Montagu, 1803)"																1	3	2
"Opalia hellenica (Forbes, 1844)"										2								
Eulima sp.	1								1					4				
"Hexaplex trunculus (Linné,1758)"								1										
"Buccinulum corneum (Linné,1758)"			1															
"Chauvetia brunnea (Donovan, 1804)"													1					
"Fusinus pulchellus (Philippi,1844)"		1	3	1	1					2								
"Nassarius incrassatus (Strøem, 1768)"		2		1	1	1		1		1	2					1		
"Mitrella scripta (Linné,1758)"										1			1					
"Vexillum tricolor (Gmelin,1790)"							1											
"Gibberula philippii (Monterosato, 1878)"					2		2											
"Granulina marginata (Bivona, 1832)"							1				1							
"Mangelia vauquelini (Payraudeau,1826)"					1								1					
"Mangiliella multilineolata (Deshayes, 1835)"			1									1						
"Haedropleura septangularis (Montagu,1803)"												1						
"Raphitoma lavrae (Philippi,1844)"								1										
"Raphitoma linearis (Montagu,1803)"					1			1				2			2			5
"Raphitoma purpurea (Montagu,1803)"														1				
"Raphitoma leufroyi (Michaud,1828)"										1	1	1						
"Arca noe Linné,1758"								1	1									
"Striarca lactea (Linné,1758)"					1		1	1	6		6		1		1	2		
Modiolus sp.														2				
Chlamys sp.													1					
"Glans trapezia (Linné,1767)"		2	4	2	4		1	4	4	3	5			2		1	2	
"Venus verrucosa Linné,1758"		1					1											
"Gouldia minima (Montagu, 1803)"							1	1				1				1	2	
"Hiatella arctica (Linné,1767)"											1							

Table 2. Species -samples data matrix.

the life cycles of the species making up the communities, may also be caused by other factors. The leaf stratum normally has a "filter effect" on air-pump methods which acts mainly on the rhizome layer; in November the seagrass has already lost most of its leaves and the filter effect might have less influence on air-pump samples than in other sampling periods (Terlizzi & Russo, 1996; Bonfitto et al., 1997).

Bittium latreillii is the dominant species and its abundance trend strongly affects the annual trend of the whole mollusc community. In fact the highest and lowest values of the dominant species coincide with those of the whole mollusc community. In addition, the annual trend of structural indices is also affected by the annual trend of the dominant species. Indeed, the highest value of diversity (H') is recorded in January, when *Bittium latreillii* abundance has a very low value. Also in another seasonal cycle study, the highest level of H' was recorded in winter at the same depth by Russo et al. (1984). The samplings were taken within a very narrow batimetric band characterised by homogenous edaphic factors in such a case, biotic factors assume a more evident role in structuring the community. In fact in this annual study there is a clear correspondence between the annual trend of the mollusc community and the annual trend of the dominant species; therefore, in a such situation, it is of major importance to study the life cycle of the dominant species for a better understanding of the dynamics of the whole malacological community of *Posidonia oceanica*.

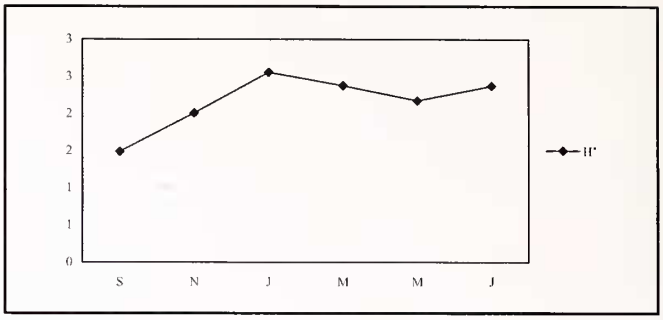

Fig.6 - Annual trend of the mean values of H'.

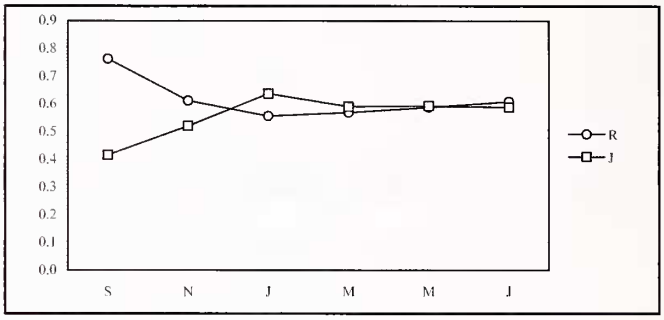

Fig.7 - Annual trends of the mean values of J; R.

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